

LAWRENCE LIVERMORE REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory, Aug. 2-6, 2010

Keeping an eye on telescopes



Retina shown with 3-micron resolution, smaller than most eye cells.

Technology used to look far into space is being flipped by Laboratory researchers and their collaborators to peer deep into the eye to earlier diagnose blinding diseases.

The device allows ophthalmologists to see individual cells in a patient's retina. Researchers are studying whether the technology also could be used to diagnose cardiovascular and dental diseases or even cancers. The same technology, called adaptive optics, which has been used for years in the astrophysics field, corrects the blurring of turbulents when scientists are searching for new stars and planets using some of the world's largest telescopes.

The technique may eventually attract a bevy of medical device makers looking to license the technology, especially since the device picked up a key patent in June.

"There's hope that this imaging methodology can work with drug companies that bring (drugs) to trial," said Scot Olivier, associate division leader for applied physics at Lawrence Livermore.

Unique microscope peers into science while it's happening



Working with the dynamic transmission electron microscope (DTEM). From left: Bryan Reed, Melissa Santala, William DeHope, Thomas LaGrange and Joseph McKeown. Photo by Jacqueline McBride/LLNL

An innovation that can help scientists observe a reaction moving at greater than 10 meters per second, with a few nanometers spatial resolution, is a feat some would say is nearly impossible.

But not the Lawrence Livermore team of scientists who developed the dynamic transmission electron microscope (DTEM).

DTEM's ability to let researchers peer into the heart of scientific phenomena while they are happening has earned it one of the 10 winning microscopy innovations in the 2010 *Microscopy Today* Innovation Award competition. *Microscopy Today's* MT-10 Awards recognize the best new products and methods across the entire field of microscopy.

Unlike traditional transmission electron microscopes that are generally restricted to capturing images before and after some rapid transformation (such as a material deforming or the growth of a nanowire), the DTEM captures images during the process itself.

To read more, go to http://www.nanotech-now.com/news.cgi?story_id=39437

New aerodynamic truck designs could cut fuel costs



The Laboratory is working to improve the fuel efficiency of semi trucks by testing drag-reducing devices. The increase in fuel efficiency could save the nation more than \$10 billion annually in diesel fuel savings.

Researchers from the Lab are working with truck maker Navistar Inc., to develop and test the devices. Aerodynamic drag is caused from pressure differences around the vehicle. At highway speeds, a semi-truck uses more than 50 percent of the energy produced by the vehicle engine to overcome aerodynamic drag, while rolling resistance consumes roughly 30 percent of the usable energy.

The devices could increase fuel efficiency by as much as 12 percent and could prevent 36 million tons of carbon dioxide from being released into the atmosphere annually, roughly the same amount of CO₂ that is emitted from four one-gigawatt power plants every year.

Ball of fusion



The National Ignition Facility's target chamber

Laboratory scientists are attempting to demonstrate that laser fusion is indeed possible.

Fusion, the same energy that powers the sun and the stars, may even someday be used to generate clean energy.

NIF's giant system sends laser beams 1,500 meters from a master oscillator to a target chamber where the 192 beams are focused on a tiny fuel pellet. In just 20 billionths of a second, the NIF's lasers deliver a payload of 500 trillion watts of power, more than 500 times the total amount of power created on the global power grid in the same amount of time.

To read more, go to <http://www.zdnet.co.uk/news/emerging-tech/2010/07/29/inside-livermore-labs-laser-fusion-facility-40089675/>

Tri-Valley reinvents itself as innovation hub



The Innovation Tri-Valley organization has commissioned an analyst firm to conduct an accelerated assessment and planning effort to spark new growth in the Tri-Valley region, an area in the East Bay that includes the cities of Danville, Dublin, Livermore, Pleasanton and San Ramon.

An assessment of the innovation potential in the Tri-Valley report reveals an extraordinary opportunity for the region to become an innovation hub of global significance. And LLNL is right in the core.

The report sheds light on what many Tri-Valley residents already tout: The only region in the United States with two national laboratories, Lawrence Livermore and Sandia; home to the headquarters of the largest company in the greater San Francisco Bay Area, Chevron (and the 11th largest in the world); a level of education in the workforce that is on par with the most advanced innovation hubs in the United States; 12.9 times the national average for high growth companies on a per capita basis; and a diverse range of market-leading companies in energy, clean-tech, software, wireless communications and robotics.

To read more, go to http://news.yahoo.com/s/prweb/20100729/bs_prweb/prweb4316454

A flower by any other name ...



The common zinnia flower may play a key role in transforming the United States from a country addicted to fossil fuels to a nation powered by cleaner, safer biofuels from renewable sources.

Livermore scientists working in collaboration with Lawrence Berkeley and the National Renewable Energy Laboratory have used four different kinds of imaging systems to get a molecular-level look into the structure of individual zinnia leaf cells. The breakthrough could speed further research into more efficient methods for breaking down the woody matter in plants to unlock the sugars that can be processed into biofuels.

To read more, go to <http://biofuelsdigest.com/bdigest/2010/07/23/lawrence-livermore-team-develop-new-imaging-techniques-for-cellulose/>

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particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

To send input to the Livermore Lab Report, send e-mail <mailto:labreport@llnl.gov>.

The *Livermore Lab Report* archive is available at:
https://publicaffairs.llnl.gov/news/lab_report/2010index.html